

Census 2000 Internet Web Site and Questionnaire Customer Satisfaction Surveys

FINAL REPORT

This evaluation reports the results of research and analysis undertaken by the U.S. Census Bureau. It is part of a broad program, the Census 2000 Testing, Experimentation, and Evaluation (TXE) Program, designed to assess Census 2000 and to inform 2010 Census planning. Findings from the Census 2000 TXE Program reports are integrated into topic reports that provide context and background for broader interpretation of results.

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EXECUTIVE SUMMARY

Census 2000 marks the first time in the history of the decennial census that the U.S. Census Bureau provided respondents with the option to submit their census form via the World Wide Web. As part of a comprehensive plan to simplify public participation and to increase response rates to Census 2000, Census Bureau staff designed a single web site to service Internet users. The site contained two major components: Internet Questionnaire Assistance and Internet Data Collection. The overall objectives were to provide census respondents with a highly secure Internet filing option to the paper-based short form questionnaire, and to assist respondents with completing their census questionnaire.

The purpose of this evaluation is to measure respondent satisfaction with the Internet Questionnaire Assistance and the Internet Data Collection. We conducted customer satisfaction surveys with users of each system. We use these survey results to analyze the degree of respondent satisfaction with each system.

Were users satisfied with the Internet Questionnaire Assistance?

Most respondents were not satisfied with the Internet Questionnaire Assistance. Nearly 62 percent of the respondents indicated that, overall, they were not at all satisfied with the Internet help screens. While nearly 77 percent of the respondents found it easy or very easy to understand the help screen information, about 58 percent said it was not at all easy to find the help topics for which they were searching. In addition, 65 percent of the respondents stated that the help screen information was not at all helpful. These findings suggest that while the information presented on the site was easy to interpret, it may not have been the appropriate information for the users.

We should note, however, that those respondents who did find the information helpful were more satisfied overall. Helpfulness of the help screen information was highly associated with overall satisfaction with the Internet help screens.

While the information on Internet Questionnaire Assistance was easy to understand, it was difficult to locate, and generally unhelpful. In short, the Internet Questionnaire Assistance did not provide the information that respondents were seeking. However, the high correlation between helpfulness and overall satisfaction indicates how we might improve customer satisfaction -- by focusing future improvements on IQA elements that are helpful to users.

Were users satisfied with the Internet Data Collection?

We took satisfaction measures on the following seven aspects of the Census 2000 Internet Form: (1) time required to load the form, (2) moving through the form, (3) availability of help screens, (4) understanding the help screen information, (5) ease of sending the form, (6) security and confidentiality procedures, and (7) overall satisfaction. Respondents were largely satisfied with most of the seven aspects related to the Census 2000 Internet Form. The percent of respondents indicating they were satisfied or very satisfied with a specific aspect was as high as 94 percent (for the item 'ease of sending form'). However, satisfaction lapsed slightly for the two items which dealt with help screens: availability of help screens and understanding the help information (74 percent and 73 percent, respectively).

While users were less satisfied with the Internet Data Collection help screens and help information, it is important to note that most respondents did not use help while completing the Census 2000 Internet Form. The percentage of respondents who chose 'Not Applicable' on questions about the usefulness of specific help topics ranged from nearly 69 percent to over 85 percent.

Overall, 91 percent of respondents were satisfied with the Census 2000 Internet Form. Given the high levels of customer satisfaction, Internet Data Collection demonstrated a strong potential for large-scale implementation in 2010.

The customer satisfaction surveys provided invaluable information regarding how well users perceived the Census 2000 web site. From these findings come our recommendations for improvements and for further research and exploration. Our key recommendations include:

- **Implement a content redesign of the Internet census help instrument. While respondents found the help screen information easy to understand, they were generally unsatisfied with the information presented. The Internet Questionnaire Assistance help information on specific census topics came primarily from the Questionnaire Reference Book, and focused on questions about the census questionnaire. Respondents had questions about much more than just the questionnaire. We need to update and enhance the information available from the Questionnaire Reference Book as well as investigate the use of other resources that would provide helpful information to users.**
- **Conduct research on knowledge and perceptions of the decennial census as well as the needs of potential users of the Census 2000 web site. While the implementation of the Census 2000 web site was somewhat small scale, it is important to put more focus on research for future projects or there will be severe limitations for a similar large-scale project in 2010. Design research based on these survey findings.**
- **Look beyond restricting online assistance to questionnaire help. To maximize customer satisfaction we should investigate all kinds of relevant census information that may be helpful to users.**
- **Conduct an evaluation during the 2004 Census Test in which evaluation methodologies and production requirements are developed simultaneously.**

1. BACKGROUND

The Census Bureau is committed to the application of technological innovations to make participation in the census enumeration simple for U.S. residents. As in the past, the primary mode of responding to Census 2000 was the mailing of a paper census form. However, as part of a comprehensive plan to simplify public participation and to increase response rates, Census Bureau staff designed a single web site that serviced Internet users who needed questionnaire assistance and/or wanted to electronically fill out and submit a completed census form.

Interest in the implementation of web surveys has increased dramatically in recent years. Dillman (2000) points out that new research is needed for identifying the best means of helping web surveys achieve their potential as an effective means for conducting sample surveys. In April 1997, the Census Bureau conducted a proof-of-concept study of collecting data via the Web. In that study, Nichols and Sedivi (1998) developed and tested a Computerized Self-Administered Questionnaire (CSAQ) with 50 companies in the 1996 Industrial Research and Development Study. They found enough positive respondent reaction to continue pursuing data collection using the Web.

Internet questionnaire assistance and data collection are new to the decennial census and were not available prior to Census 2000. An increase in public awareness and use of the Internet presents new opportunities for questionnaire administration. Originally, the Census 2000 Dress Rehearsal planned to include Internet Data Collection (IDC). However, based on the public perception that the Internet was insecure, the Census Bureau canceled Internet data collection plans (Coon, 1999).

For Census 2000, we revisited IDC and implemented strict security measures. This was also the first time we implemented Internet Questionnaire Assistance (IQA).

The major objectives of the Census 2000 IQA effort were to:

- provide online help to respondents who need assistance completing traditional paper forms (long and short),
- provide online help to respondents who need assistance completing the web-based Internet short form (IDC questionnaire),
- allow respondents to search for help on specific questionnaire items,
- provide general information about the census form, and
- provide answers to Frequently Asked Questions (FAQs) about Census 2000 (Coon, 1999).

IQA consisted of a collection of webpages and contained all of the materials from the Census 2000 Questionnaire Reference Book (QRB) and other general Census 2000 information. It allowed users to search an alphabetic list of topics or select a popular help topic from a pull down menu. The QRB contained descriptions relating to the use of and how to fill out each questionnaire item. The QRB was also adapted for the Census 2000 Telephone Questionnaire Assistance (TQA) operation. Along with information from IQA and TQA specifications, the

QRB formed the basis of a core knowledge database which underlies both the TQA and IQA systems for Census 2000.

The major objectives of the Census 2000 IDC effort were to:

- supplement more traditional data collection methods,
- develop experience in IDC for forthcoming censuses, and
- provide respondents with another response option (Coon, 1999).

Census respondents were eligible to answer an English language version short-form questionnaire on the Census 2000 web site if they could provide a valid 22-digit housing unit ID. Valid housing unit IDs included those from the following forms:

- Mailout/Mailback Short Form [D-1]
- Update/Leave Short Form [D-1(UL)]
- Puerto Rico Update/Leave Short Form [D-1(UL)PR]
- Response Mode and Incentive Experimental Short Forms [S-900.1, S-900.4, S-900.7]

Census Bureau staff designed the Census 2000 Internet Form to mirror the paper form as closely as possible within technical constraints/limitations. That is, the wording of the questions and the skip patterns were the same. Like the paper form, the electronic form had space to provide data for six persons and names for up to 12 persons. Restricted access to the Census 2000 Internet Form, by means of the 22-digit housing unit ID, prevented unauthorized access to the system.

1.1 Implementation of IQA and IDC

IQA was online from March 3, 2000 to July 7, 2000. IDC was brought online on March 3, 2000 for stateside and Puerto Rico Update/Leave operations. However, the mailout/mailback version was not brought online until March 13, 2000. IDC was taken off-line on April 18, 2000, when the Census Bureau began Nonresponse Followup (NRFU). As part of the Response Mode Incentive Experiment (RMIE), a special mailing was sent to a selected group of people determined to be nonrespondents, which asked them to complete their census form via the Internet. The web site for these NRFU people was available from April 29, 2000 to June 3, 2000.

1.2 Development of the customer satisfaction surveys

In 1993, the National Performance Review (now known as the National Partnership for Reinventing Government) was formed to help create customer focused government, and the Congress passed nearly 100 laws to support a more effective and efficient government. Since then, a key goal of the government is to ensure that the Federal government provides the highest quality services to the American people. The Census Bureau believes strongly in the importance of excellent customer service and has defined five standards of customer service.¹ The standard

¹The five standards are Excellence, Timeliness, Responsiveness, Accessibility, and Commitment.

of accessibility states that the Census Bureau will provide its customers with choices for products, services, and the means of delivery. To do this, the Census Bureau will periodically survey their customers to assess their needs, and will use the results of these customer surveys for product development. In support of this government-wide initiative to measure customer satisfaction with government services, we conducted customer satisfaction surveys with users of IQA and IDC.

2. METHODS

2.1 Sample design of the customer satisfaction surveys

We selected a sample of IQA users to fill out the survey by a link made available on various pages throughout the IQA system. For IDC, we selected the sample from respondents who successfully submitted their census form online. Additionally, all NRFU respondents selected through the RMIE had the option of completing the survey.

The sample designs for both IDC and IQA are as follows:

- The IQA universe includes all IQA users. We selected a sample of these users based on time. The survey was initially open to IQA users who visited during a pre-selected five-minute window each hour. However, on April 6, 2000 the window was increased to 15 minutes for the remainder of the data collection period because of low response to the survey.
- The IDC universe includes only those respondents who submit their census questionnaire via the Census 2000 web site. We selected a sample of these respondents based on time; that is, the survey was open to respondents who submitted their census form online during a pre-selected five-minute window each hour. The survey was available for five minutes, each hour, for every hour of the day.

2.2 Data analysis

To analyze the customer satisfaction survey data, we will present various descriptive statistics. Frequencies, proportions, and unweighted means and variances are presented in tables to summarize, describe, and organize the data.

2.3 The gamma statistic

Our survey data is ordinal by nature. A basic question usually posed when analyzing ordinal data is “Does Y tend to increase as X increases?” Bivariate analyses of interval-scale variables often summarize covariation by the Pearson correlation, which describes the degree to which Y has a linear relationship with X. Ordinal variables do not have a defined metric, so the notion of linearity is not meaningful. However, the inherent ordering of categories allows consideration of monotonicity—that is, whether Y tends to increase as X does. (Agresti 1990).

The gamma statistic is a measure of association for ordinal variables and is analogous to the Pearson correlation. It describes the degree to which the relationship is monotone. When comparing two respondents on an ordinal scale, we can classify the pair of respondents as concordant or discordant. Agresti (1990) states, “The pair is concordant if the subject ranking higher on variable X also ranks higher on variable Y. The pair is discordant if the subject ranking higher on X ranks lower on Y. The pair is tied if the subjects have the same classification on X and/or Y.”

The sample gamma is defined:

$$\hat{\gamma} = \frac{(C - D)}{(C + D)}$$

where C is the total number of concordant pairs and D is the total number of discordant pairs.

2.4 Multi-dimensional scaling

We used multi-dimensional scaling to create a simultaneous graphical representation of all the estimated gammas. According to Borg (1997), multi-dimensional scaling represents a measure of relative similarity or dissimilarity among pairs as distances between points of a low-dimensional multi-dimensional space. In our case, we use the gamma statistic as a measure of association in a two-dimensional space. The points are configured such that their distances correspond to the gamma values. That is, two points that are close together are highly associated relative to two points that are far apart.

2.5 Use of a log-linear model

There are many situations where several factors interact with each other in a multivariate manner. We used a log-linear model to analyze our categorical data. They describe the means of cell counts in a multidimensional table and do not look upon any one variable or dimension as the response to the others (Zelterman, 1990). We build and select a log-linear model that best describes the relationship between seven IDC satisfaction measures.

2.5.1 The G^2 statistic

When building a log-linear model, we compute the G^2 statistic as a measure of how well the model fits. We then compare the G^2 of different models to determine which best fits the data, i.e. describes the associations. The associations that are in our final model are significant, and those not in the final model are not. The G^2 statistic is defined:

$$G^2 = 2 \sum_i n_i \log \left(\frac{n_i}{\hat{m}_i} \right)$$

Where n_1, \dots, n_k denote the multinomial vector with respective fitted values $\hat{m}_1, \dots, \hat{m}_k$ according to some log-linear model. The G^2 statistic ‘quantifies’ the difference between the n and \hat{m} . When these are very different from each other we are generally dissatisfied with the model

being fitted. If n and m are closer in value we haven't proved the model is correct but rather feel less anxious about drawing inferences from the model (Zelterman, 1990). See Appendix B for more information on log-linear models.

2.6 Applying quality assurance procedures

We applied quality assurance procedures throughout the creation of this report. They encompassed how we determined evaluation methods, created specifications for project procedures and software, designed and reviewed computer systems, developed clerical and computer procedures, analyzed data, and prepared this report. For a description of these procedures, see the binder "Census 2000 Evaluation Program Quality Assurance Process."

3. LIMITS

When considering the results of the evaluation, keep in mind several limits:

- Because of the unique environment of the Internet and the administration methods of our survey, we are unable to identify the exact number of people exposed to the IQA survey invitation. We can only identify the number of 'hits' to the survey link, which is not equivalent to the number of unique people exposed to the link². Therefore it is impossible to compute an accurate response rate for IQA.
- Historically, customer satisfaction surveys have low response rates. Therefore, nonresponse bias may limit the generalization of the survey data.
- Due to the self-selected response nature of the surveys, the results may suffer from response bias. Respondents are likely to represent customers with stronger feelings (very satisfied or very dissatisfied) compared to those who don't take the time to respond (Wellens and Martin). This effect may be evident in the overwhelming satisfaction of the IDC customer satisfaction survey respondents.
- RMIE survey respondents were ultimately excluded from this analysis because their selection process was different than all other survey respondents. In addition, there were not enough RMIE respondents to produce reliable estimates of group differences.

²Web page hits are not an accurate measure of web traffic volume. They can be used as a relative measure of one page's hits relative to another page's hits, or one server's hits relative to another server's. Web hits are a poor measure of traffic volume, but in most cases it is the only measure available.

4. RESULTS

4.1 IQA customer satisfaction survey

Response to the IQA customer satisfaction survey was low, with just 234 completed surveys. We were unable to compute a response rate, as the number of people who saw or clicked on the link to the survey is unknown. As described in Section 3, access to the survey was tracked in ‘hits’, and there is not a stable way to relate ‘hits’ to number of people.

4.1.1 *Were respondents satisfied with IQA?*

Nearly 62 percent of the respondents indicated that, overall, they were not at all satisfied with the Internet help screens. While nearly 77 percent of the respondents found it easy or very easy to understand the help screen information, about 58 percent said it was not at all easy to find the help topics for which they were searching. In addition, 65 percent of the respondents stated that the help screen information was not at all helpful.

These findings suggest that while the information presented on the site was easy to interpret, it may not have been the appropriate information for the users. That is, IQA did not provide the information that users were seeking. Mayhew (1992) notes that “...fancy formatting, navigational ease and ease of access...will not be of much use if the information contained in the help system is not the information users seek. Clearly, basic research into help *content* is required.” Mayhew also provides some basic principles and guidelines to be used when designing on-line help. These include:

- Make help visible: “advertise”
- Make it complete and accurate
- Organize help around user tasks and goals
- Provide different levels of detail under user control

Horton (1990) suggests similar guidelines including, “...do not merely replicate or mimic the exact features of paper documents.”

Table 1 presents data obtained from respondents who rated the following items on a three-point scale: (1) ease of finding help topics, (2) ease of understanding the help screen information, (3) helpfulness of help screen information, and (4) overall satisfaction with help screens.

Table 1. Satisfaction ratings for IQA

	N	Percent Not at all easy	Percent Easy	Percent Very easy
1. Ease of finding help topics	225	57.8 (3.30)	21.3 (2.74)	20.9 (2.72)
2. Understanding the help screen information	220	23.2 (2.85)	48.2 (3.38)	28.6 (3.05)

	N	Percent Not at all helpful	Percent Helpful	Percent Very helpful
3. Helpfulness of the help screen information	217	65.0 (3.38)	21.7 (2.80)	13.4 (2.31)

	N	Percent Not at all satisfied	Percent Satisfied	Percent Very Satisfied
4. Overall satisfaction with help screens	220	61.8 (3.28)	26.4 (2.98)	11.8 (2.18)

† Standard errors appear in parentheses.

4.1.2 What are the associations between IQA satisfaction measures?

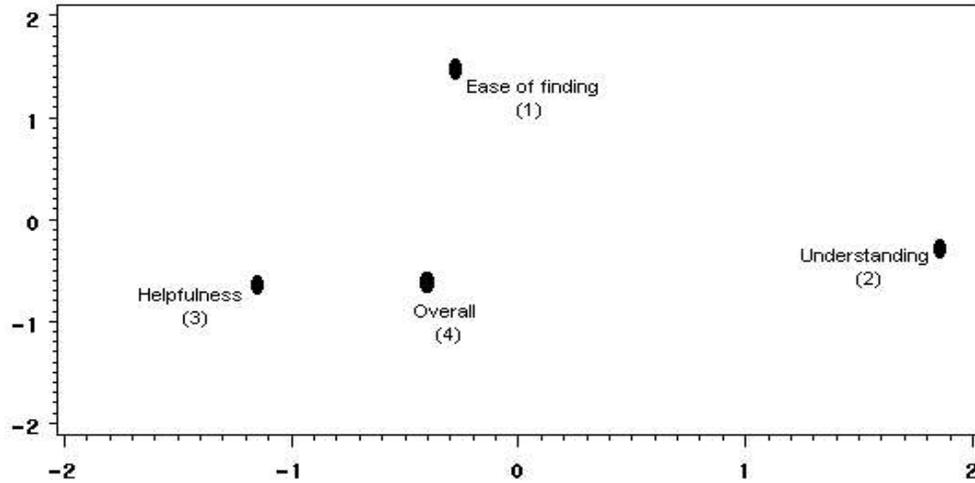
We used the gamma statistic as a measure of association for the ordinal IQA variables. We found a strong association between helpfulness of the help screen information and overall satisfaction with the help screens (0.9693). Overall satisfaction is also highly associated with ease of finding help information (0.8606) and understanding the help information (0.7167). Table 2 shows the gamma statistics used to examine the relationship between the same four measures studied in Table 1. We are primarily interested in how each measure is associated with overall satisfaction.

Table 2. Associations between IQA satisfaction measures

	Ease of finding	Understanding	Helpfulness	Overall satisfaction
1. Ease of finding	1.0000	0.6607	0.7890	0.8606
2. Understanding		1.0000	0.5291	0.7167
3. Helpfulness			1.0000	0.9693
4. Overall satisfaction				1.0000

Figure 1 presents the same results in a graphical representation using multi-dimensional scaling. As we can see, helpfulness of the help screen information (3) is the closest point to overall satisfaction (4), hence the strongest association.

Figure 1. Multi-dimensional scaling for associations between IQA satisfaction measures



4.1.3 From what location did users access IQA?

Seventy-six percent of the respondents accessed the site from home, while 18 percent accessed from work. There were less than 10 respondents each for the ‘library’, ‘school’, or ‘some other location’ categories. Table 3 shows the locations from which IQA users primarily accessed the Census 2000 Internet help screens. Some data are withheld due to insufficient sample sizes.

Table 3. Location from which IQA users accessed Census 2000 help screens

Location	Frequency	Percent
Home	169	76.5 (2.86)
Work	40	18.1 (2.60)
Library	---	---
School	---	---
Other	---	---
Total	221	100.0

† Standard errors appear in parentheses

4.1.4 How did IQA users hear about the Census 2000 help screens?

The most often cited source was the TQA toll-free line (32 percent). This is not surprising, since the initial telephone greeting told callers they could obtain help at any time at www.2000.census.gov. The main Census web site (www.census.gov) was noted by approximately 23 percent of the respondents. This site contained a direct link to the Census 2000 web site. A good number of respondents (14 percent) selected the media (television/newspaper/radio) as their source. Respondents indicated where they heard about the Census 2000 Internet help screens by marking one or more of the ten given categories.

Table 4 gives the distribution of how users heard about the help screens. Respondents could mark more than one answer, therefore responses do not add to 100 percent. Some data are withheld due to insufficient sample sizes. Figure 2 presents the same information in a bar graph.

Table 4. How IQA users heard about the Census 2000 help screens

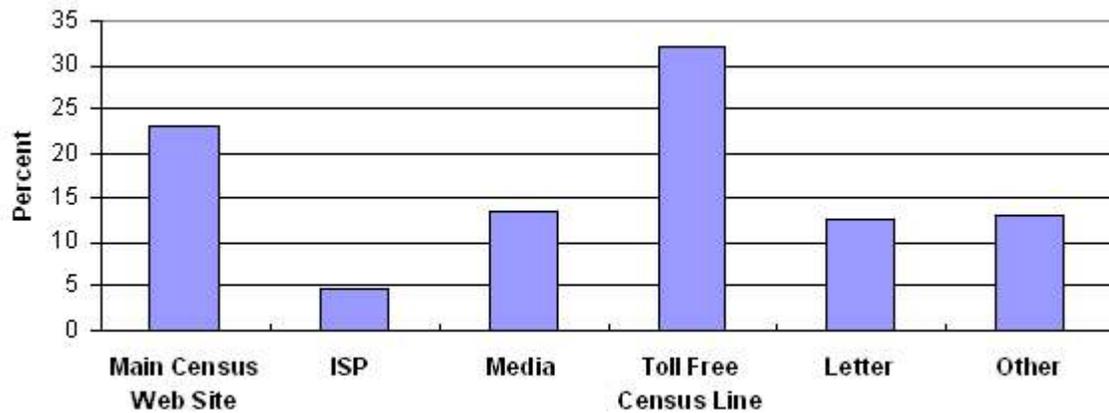
Source	Frequency	Percent of Total # of Respondents
Main U.S. Census Bureau web site	50	23.3 (2.89)
Internet service provider (ISP)	10	4.7 (1.44)
Major web site	---	---
Internet news web site	---	---
Other Internet site	---	---
Television/Radio/Newspaper (Media)	29	13.5 (2.34)
Toll free Census telephone help line	69	32.1 (3.19)
Census In Schools program	---	---
Letter attached to the Census form	27	12.6 (2.27)
Other	28	13.0 (2.30)
Total # of Respondents	215	NA

† Standard errors appear in parentheses.

†† Respondents could mark more than one response.

NA – Table does not add to 100 percent.

Figure 2. How IQA users heard about the Census 2000 help screens



4.1.5 IQA respondents' intention to submit census form online

We designed two survey questions to obtain an estimate of the proportion of IQA users who intended to submit their census form through IDC (See Questions 4 and 5 in Appendix A-1). Of all respondents, just 16 percent intended to submit their census form online. Of those who did not intend to submit their census form online, 20 percent noted that they had already completed the paper form and 15 percent noted that their form type was not available to complete online.

As shown in Table 5, about half of the respondents knew that some forms were available to complete online. Table 6 presents the breakdown of respondents' intention to submit their census form online. It also gives the reasons why respondents chose not to submit their census form online. Respondents could mark more than one reason. Figure 3 presents the same information in a bar graph.

Table 5. Percent of IQA respondents who knew about the online census forms

Knowledge of availability	Frequency	Percent
Yes	115	51.6 (3.35)
No	108	48.4 (3.35)
Total	223	100.0

†Standard errors appear in parentheses.

Table 6. IQA respondents' intention to submit census form online

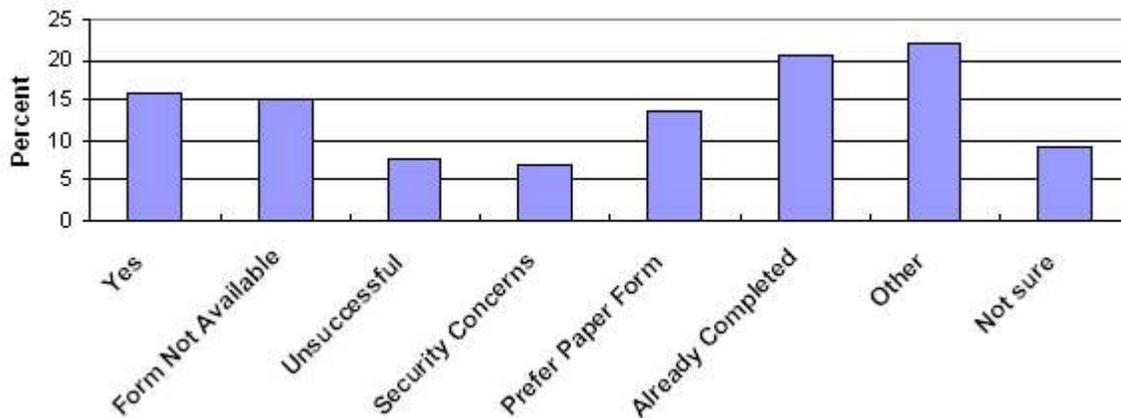
Intention to submit the form	Frequency	Percent of Total # of Respondents
Yes	35	15.9 (2.47)
No	188	85.5 (2.38)
Form not available	33	15.0 (2.41)
Unsuccessful submission	17	7.7 (1.80)
Security concerns	15	6.8 (1.70)
Prefer paper form	30	13.6 (2.32)
Already completed paper form	45	20.5 (2.73)
Other reasons	48	21.8 (2.79)
Not sure	20	9.1 (1.94)
Total # of Respondents	220	NA

† Standard errors appear in parentheses.

†† Respondents could mark more than one response.

NA - Table does not add to 100 percent.

Figure 3. IQA respondents' intention to submit census form online



4.2 IDC customer satisfaction survey

Response to the IDC customer satisfaction survey was much higher than to the IQA survey. There were 3,226 completed surveys. We estimated response rates by each day in the data collection period, for an overall average response rate of 58.5 percent. (See Appendix E for daily response rates.)

4.2.1 *Who were the IDC respondents?*

We were able to obtain a demographic profile of IDC respondents by matching their 22-digit census ID to their IDC survey responses. We found that the IDC respondents were primarily male (75 percent), white (78 percent), not of Hispanic origin (92 percent), and 25-54 years old (77 percent). This profile reflects the first person listed on the census form, and may not be the customer satisfaction survey respondent in all cases. Thus, our finding that over 75 percent of our respondents were male is likely a reflection of census respondents' tendency to list the male head of household as the first person on the census form, regardless of who is the actual respondent (DeMaio and Bates, 1990).

4.2.2 *Were respondents satisfied with IDC?*

Overall, 91 percent of respondents were satisfied with the Census 2000 Internet Form. Additionally, respondents were satisfied with nearly all aspects of the Census 2000 Internet Form, with satisfaction levels as high as 94 percent. Satisfaction lapsed slightly for the two items which dealt with the help screens: availability of help screens and understanding the help information (74 percent and 73 percent, respectively).

We should note that respondents answered the two items concerning help screens nearly identically, therefore it is likely that they may not have made a distinction between the two questions. For these two items, we also included the percent by only those respondents who actually used help screens. We see that respondents who used help screens were somewhat more satisfied with the availability of help information and understanding the help information (83 percent and 82 percent, respectively) than all respondents taken together. That is, some respondents who didn't use any help screens tended to rate them on the lower end of the scale rather than selecting 'Not Applicable'.

Table 7 presents respondents' level of satisfaction with certain aspects of the Census 2000 Internet Form. Respondents indicated, on a 5-point scale, their level of satisfaction with each of the following items:

- (1) time required to load the form,
- (2) moving through the form,
- (3) availability of help screens,
- (4) understanding the help information,
- (5) ease of sending the form,
- (6) security and confidentiality procedures, and
- (7) overall satisfaction.

In Table 7, ‘Satisfied’ reflects the selection of a four or five on the five-point response scale. (See Appendix C for a complete breakdown of responses.) Although a score of three represents neither satisfaction nor dissatisfaction, we excluded these counts to obtain a conservative estimate of satisfaction. Figure 4 presents the same data in a bar graph.

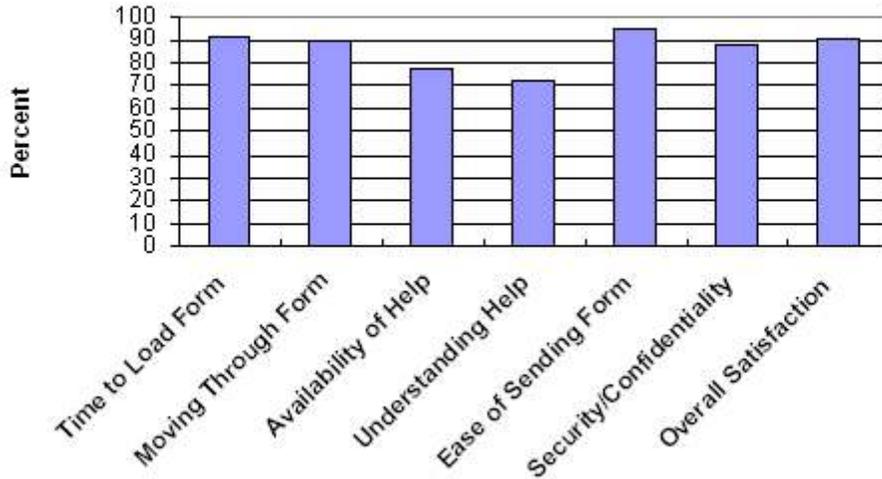
Table 7. IDC satisfaction ratings for the Census 2000 Internet Form

Variable	N	Percent Satisfied
1. Time required to load the form	3216	92.2 (0.47)
2. Moving through the form	3210	90.5 (0.52)
3. Availability of help screens	3118	73.7 (0.79)
Among Help Users Only*	1593	83.1 (0.94)
4. Understanding the help information	3096	72.5 (0.80)
Among Help Users Only*	1587	81.6 (0.97)
5. Ease of sending the form	3199	94.2 (0.42)
6. Security and confidentiality procedures	3192	87.9 (0.58)
7. Overall Satisfaction	3198	91.0 (0.51)

† Standard errors appear in parentheses.

*This row includes only those respondents who used at least one help screen.

Figure 4. IDC satisfaction ratings for the Census 2000 Internet Form



4.2.3 What are the associations between IDC satisfaction measures?

We used the gamma statistic as a measure of association for the ordinal IDC variables. We found a strong association between availability of the help screens and understanding the help information (0.9461). This strong association confirms our earlier claim that respondents answered these two questions similarly. Overall satisfaction is highly associated with ease of sending the form (0.8820), moving through the form (0.8604), and time required to load the form (0.8420).

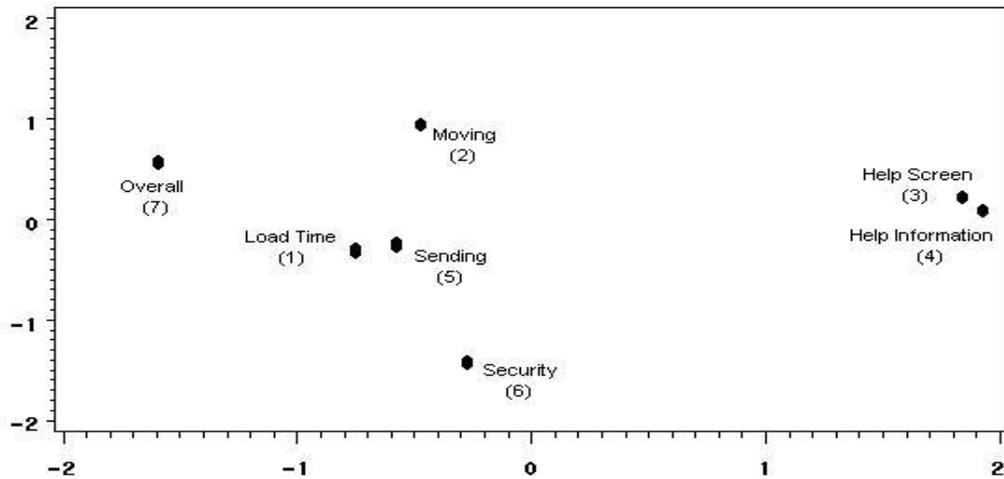
Table 8 presents the gamma statistic which examines the relationship between the seven measures studied above. We are primarily interested in how each measure is associated with overall satisfaction.

Table 8. Associations between IDC satisfaction measures

Gamma	1	2	3	4	5	6	7
1. Time required to load the form	1.0000	0.9050	0.7072	0.7044	0.9408	0.8063	0.8420
2. Moving through the form		1.0000	0.7546	0.7310	0.9349	0.7943	0.8604
3. Availability of the help screens			1.0000	0.9461	0.7552	0.7105	0.6794
4. Understanding the help information				1.0000	0.7520	0.7088	0.6852
5. Ease of sending the form					1.0000	0.8817	0.8820
6. Security and confidentiality procedures						1.0000	0.8040
7. Overall satisfaction							1.0000

Figure 5 gives the multi-dimensional scaling of the seven measures. In Figure 5, we see that the time required to load the form (1), ease of moving through the form (2), and ease of sending the form (5) are the three closest points to overall satisfaction (7), indicating that each has a strong association with overall satisfaction.

Figure 5. Multi-dimensional scaling for associations between IDC satisfaction measures



4.2.4 Log-linear modeling

In Table 8, there is no clear definition of what is considered a significant association. According to Agresti (1990), for an I x J table, it is rarely possible to summarize association by a single number without some loss of information. We used a log-linear model to further describe the relationship between the IDC satisfaction measures. Just as a multiple regression model is more informative than a simple correlation, the log-linear model describes associations and provides more information than the univariate gamma statistic. We examined all the possible interactions of the seven variables that describe IDC satisfaction. We systematically fit several models to find which interactions are needed to explain the data well.

Our best model includes almost all of the possible two-way interactions excluding the interactions AB,BG,BE,CD,CG³ (See Appendix D for a log-linear model comparison). That is, all two way interactions are important in describing satisfaction except:

³A=Time required to load the form E =Ease of sending the form
 B=Availability of help screens F=Security and confidentiality concerns
 C=Understanding of help information G=Overall Satisfaction
 D=Moving through the form

- time required to load the form and availability of the help screens (AB)
- availability of the help screens and overall satisfaction (BG)
- availability of the help screens and ease of sending the form (BE)
- understanding the help information and moving through the form (CD)
- understanding the help information and overall satisfaction (CG)

Three of the non-significant interactions (AB,BE,CD) are not surprising. We wouldn't necessarily expect these interactions to be important. The non-significance of the interactions (BG,CG) is, however, quite intriguing. One could assume that every variable would be significantly associated with overall satisfaction. We see that this isn't the case for availability of the help screens and understanding the help information. Thus, the interactions of availability of the help screens and understanding the help information with overall satisfaction are not as important in describing the data as the other variables with overall satisfaction.

Recall that the gamma statistic relates the relative degree of association between two variables. The gamma values for the interactions of availability of help screens and understanding the help information with overall satisfaction were smaller than the other variables' association with overall satisfaction. This is consistent with our final log-linear model. The associations might also be low because, as we will see in Table 9, not many respondents used the help screens. Therefore, in general, respondents may not have had a strong opinion concerning the help screens.

4.2.5 How useful were the IDC help topics?

On the whole, just about half of the respondents used one or more help topics. Of those respondents who did use the help screens, most were satisfied. Respondents rated the usefulness of the twelve help topics embedded in the online census form. Respondents found information on these twelve topics by clicking on the blue linked text throughout the census form.

Before discussing the usefulness of these items it is important to note that the respondents did not use the IDC help links often. The percent of respondents who reported that they did not use the help links ranged from nearly 69 percent to 85 percent for each particular help topic. This is important to note, as it reflects other literature that suggests that users rarely use help when available. Mayhew (1992) suggests that "users worry that if they go into help they will not be able to get back to the place where they were working. Remembering how to navigate in help adds a burden to short-term memory. The help information may obscure part of the screen, interrupting the user's primary task and causing loss of context." Schneiderman (1998) suggests that "users' navigation among online help segments should be recorded and studied, so that we can gain a better understanding of what help segments are effective."

Table 9 and Figure 6 show the percent of respondents who used the help links for each particular help topic. Table 10 and Figure 7 present the usefulness ratings of only those respondents who used at least one help topic. The percent of respondents who marked topics 'very useful' ranged from 49 percent (Race) to 69 percent (Security/Confidentiality). The help topics most prevalent in the 'not at all useful' category were Hispanic origin (20 percent), Race (18 percent), and Telephone number (16 percent).

Table 9. Usefulness of IDC help topics

Help Topics	N	Percent Used Help	Percent Did not use help
Verify form authenticity	3071	30.5 (0.83)	69.5 (0.83)
Number of people in household	3048	17.8 (0.69)	82.2 (0.69)
Home ownership/rent	3046	17.0 (0.68)	83.0 (0.68)
Name	3044	16.1 (0.67)	83.9 (0.67)
Relationship	3032	14.5 (0.64)	85.5 (0.64)
Age/Date of birth	3031	17.4 (0.69)	82.6 (0.69)
Hispanic origin	3022	15.0 (0.65)	85.0 (0.65)
Race	3032	18.5 (0.70)	81.5 (0.70)
Telephone number	3026	16.0 (0.67)	84.0 (0.67)
Submitting the form	3032	21.1 (0.74)	78.9 (0.74)
Security/Confidentiality	3023	31.1 (0.84)	68.9 (0.84)
OMB approval number	2998	20.1 (0.73)	79.9 (0.73)

† Standard errors appear in parentheses.

Figure 6. Usefulness of IDC help topics

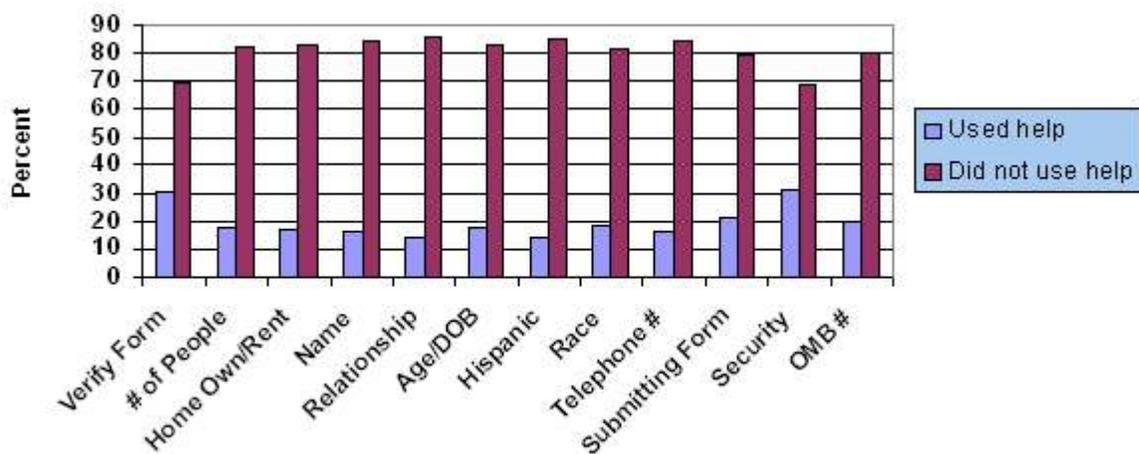
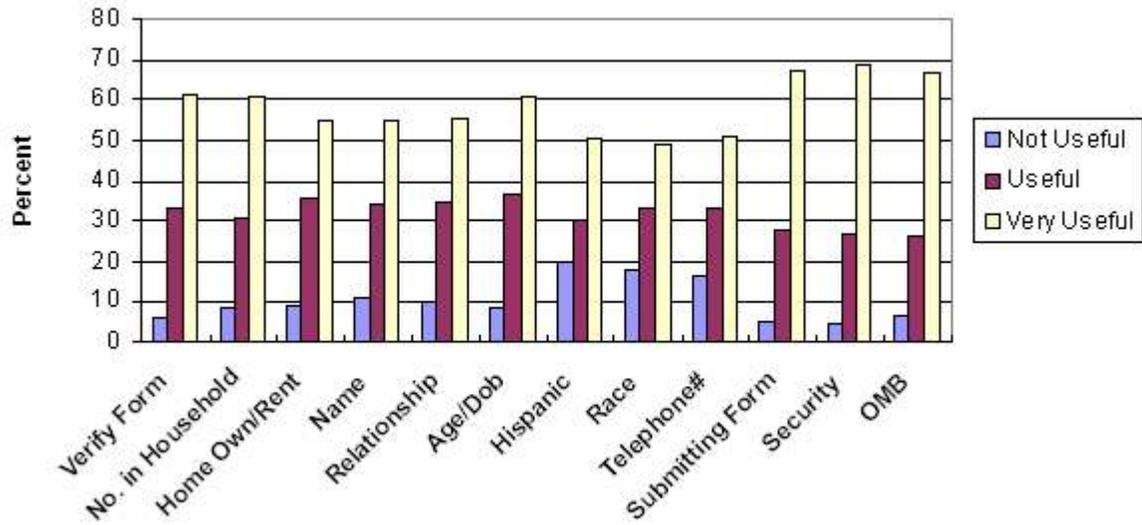


Table 10. Usefulness of IDC help topics among respondents who used one or more help topics

Help Topics	N	Percent Not at all Useful (1)	Percent Useful (2)	Percent Very Useful (3)
Verify form authenticity	936	6.2 (0.79)	32.9 (1.54)	60.9 (1.60)
Number of people in household	542	8.7 (1.21)	30.8 (1.99)	60.5 (2.10)
Home ownership/rent	519	9.3 (1.27)	35.7 (2.10)	55.1 (2.19)
Name	489	11.0 (1.42)	34.2 (2.15)	54.8 (2.25)
Relationship	441	10.2 (1.44)	34.5 (2.27)	55.3 (2.37)
Age/Date of birth	528	8.7 (1.23)	30.9 (2.01)	60.4 (2.13)
Hispanic origin	452	19.9 (1.88)	29.9 (2.16)	50.2 (2.35)
Race	560	17.9 (1.62)	33.0 (1.99)	49.1 (2.11)
Telephone number	484	16.3 (1.68)	33.3 (2.14)	50.4 (2.28)
Submitting the form	641	5.2 (0.87)	27.5 (1.76)	67.4 (1.85)
Security/Confidentiality	940	4.4 (0.67)	26.9 (1.45)	68.7 (1.51)
OMB approval number	604	6.8 (1.02)	26.3 (1.79)	66.9 (1.92)

† Standard errors appear in parentheses.

Figure 7. Usefulness of IDC help topics among respondents who used one or more help topics



4.2.6 From what location did users access IDC?

Eighty-five percent of respondents submitted their Census 2000 Internet Form from home, while almost 14 percent accessed the site from work. Less than one percent submitted their form from a school or some other place. Fewer than ten respondents selected 'library'. Table 11 shows the locations from which IDC users primarily accessed the Census 2000 Internet Form. Some data are withheld due to insufficient sample size.

Table 11. Location from which IDC users accessed the Census 2000 Internet Form

Location	Frequency	Percent
Home	2728	85.3 (0.63)
Work	435	13.6 (0.61)
School	---	---
Library	---	---
Some other place	22	0.7 (0.15)
Total	3199	100.0

†Standard errors appear in parentheses.

4.2.7 How did IDC users hear about the Census 2000 Internet form?

The media (television/radio/newspaper) was the most marked answer, with over 52 percent. This is not surprising, since IDC was not a part of the Census 2000 advertising campaign, and publicity came primarily from the media. The Census 2000 Home Page was marked by over 14 percent of respondents. Surprisingly, almost ten percent of respondents said that they heard about the Census 2000 Internet Form through the letter attached to the Census form. However, only households selected for the RMIE actually received a letter informing them of the Internet filing option. Respondents may have confused this response option with the advance letter, which contained the Census web address, but did not mention the Census Internet Form.

Table 12 gives the distribution of where users heard about the Census 2000 Internet Form. Respondents indicated where they heard about the Census 2000 Internet Form by marking one or more of the 11 given categories. Since respondents could mark more than one response, the responses do not add to 100 percent. Figure 8 presents the information in a bar graph.

Table 12. How IDC users heard about the Census 2000 Internet Form

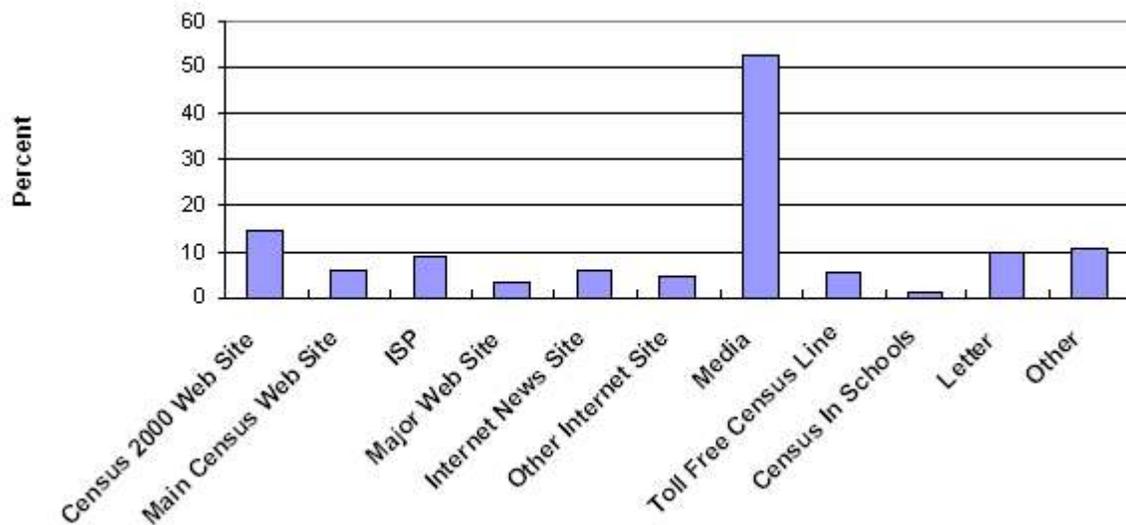
Source	Frequency	Percent of Total # of Respondents
Census 2000 Home Page	454	14.3 (0.62)
Main U.S. Census Bureau web site	187	5.9 (0.42)
Internet service provider	288	9.1 (0.51)
Major web site	103	3.3 (0.32)
Internet news web site	183	5.8 (0.41)
Other Internet site	136	4.3 (0.36)
Television/Radio/Newspaper (Media)	1658	52.4 (0.89)
Toll free Census telephone help line	169	5.3 (0.40)
Census In Schools program	28	0.9 (0.17)
Letter attached to the Census form*	310	9.8 (0.53)
Other	342	10.8 (0.55)
Total # of Respondents	3167	---

†Standard errors appear in parentheses.

††Respondents could mark more than one response.

* The letter was included with Census materials only for those households selected for the RMIE.

Figure 8. How IDC users heard about the Census 2000 Internet Form



5. RECOMMENDATIONS

The customer satisfaction surveys provided some very insightful information regarding how well the users perceived the Census 2000 web site. Overall, respondents were quite satisfied with IDC. On the other hand, users were generally unsatisfied with IQA and the help information contained within. Taken together, these results suggest a variety of areas for further research and exploration.

5.1 System Design

- Implement a content redesign of the Internet census help instrument. While respondents found the help screen information easy to understand, they were generally unsatisfied with the information presented. The IQA help information on specific census topics came primarily from the QRB, and focused on questions about the census questionnaire. Respondents had questions about much more than just the questionnaire. We need to update and enhance the information available from the QRB as well as investigate the use of other resources that would provide helpful information to users.

5.2 Customer satisfaction survey implementation

- To increase survey quality with better user representation, consider alternate survey implementation choices, such as a pop-up survey rather than a link. Advantages of using a pop-up survey include:
 - Systematic selection of every 'nth' visitor
 - Survey automatically pops up on screen (using a new browser window)
 - Use of "cookies" to ensure that each user only completes the survey once.

5.3 Research and Testing

- Conduct research on knowledge and perceptions of the decennial census. The implementation of the Census 2000 web site was somewhat small scale, and did not require extensive research prior to implementation. However, it is important to put more focus on research for future projects or there may be severe implications for a similar large-scale implementation in 2010. Design research based on these survey findings.
- Look beyond restricting online assistance to questionnaire help. To maximize customer satisfaction we should investigate all kinds of relevant census information that may be helpful to users.
- Incorporate usability testing to explore the user expectations and preferred content of IQA.
- Conduct an evaluation during the 2004 Census Test in which evaluation methodologies and production requirements are developed simultaneously.

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The Census Bureau would like to know how well the Census 2000 Internet help screens worked for you. Please take a few moments to answer our questions and give us your opinions about the on-line help. Your answers are voluntary and confidential and will help us learn where improvements are needed in future Census Internet products. Thank you in advance for your participation.

1. A. How easy was it for you to find the topics you were looking for while using the Internet help screens?

Not at all easy Easy Very easy
 1 2 3

B. Overall, how easy was it to understand the Internet help screen information?

Not at all easy Easy Very easy
 1 2 3

C. Overall, how helpful to you was the Internet help screen information?

Not at all helpful Helpful Very helpful
 1 2 3

D. Overall, how satisfied are you with the Internet help screens?

Not at all satisfied Satisfied Very satisfied
 1 2 3

2. From which location did you primarily use the Census 2000 Internet help screens?

- Home
- Work
- School
- Library
- Some other place, please specify_____

Appendix A-1: IQA Survey

3. How did you hear about the Census 2000 Internet help screens? Please mark all that apply.

- G From the Main U.S. Census Bureau web site (www.census.gov)
- G From an Internet Service Provider (AOL, MSN, Mindspring, etc.)

- G From a major web site (Yahoo, Netcenter, AltaVista, etc.)
- G From an Internet news web site (ABC, MSNBC, CBS, etc.)
- G From some other Internet site (not covered above)

- G Through television/radio/newspaper
- G Through the toll free Census telephone help line
- G Through the Census In Schools Program

- G Through the letter attached to the census form you received in the mail
- G Other, please specify_____

4. Did you know that some census forms are available for you to complete through the Census 2000 web site?

Yes No

5. Do you intend to submit your census form through the Census 2000 web site?

- Yes
- No, my type of form was not available through the Census 2000 web site.
- No, I tried to submit the Internet form and was unsuccessful.
- No, I have security concerns.
- No, I prefer to use the paper form.
- No, I have already completed the paper form.
- No, some other reason, please specify_____
- Not sure

Submit this survey

3. While you were completing the Census 2000 Internet Form, help was available for a variety of topics (if you clicked on the linked text). In the following chart, please mark how useful the help information was to you. For topics on which you did not use help, please mark 'NA'.

Help Topics	How useful was the information?			
	Not at all Useful 1	Useful 2	Very Useful 3	Did not use this topic NA
Verify form authenticity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of people in household	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Home ownership/rent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Name	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relationship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Age/Date of birth	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hispanic origin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Race	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Telephone number	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Submitting the form	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Security/Confidentiality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OMB approval number	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. From which location did you submit your Census 2000 Internet Form?

- Home
- Work
- School
- Library
- Some other place, please specify _____

5. How did you hear about the Census 2000 Internet Form? Please mark all that apply.

- G From the Census 2000 Home page (www.2000.census.gov)
- G From the Main U.S. Census Bureau web site (www.census.gov)
- G From an Internet Service Provider (AOL, MSN, Mindspring, etc.)

- G From a major web site (Yahoo, Netcenter, AltaVista, etc.)
- G From an Internet News web site (ABC, MSNBC, CBS, etc.)
- G From some other Internet site (not covered above)

- G Through television/radio/newspaper
- G Through the toll free Census telephone help line
- G Through the Census In Schools Program

- G Through the letter attached to the census form you received in the mail
- G Other, please specify_____

Submit this survey

Log-linear models

Screening and building a log-linear model

First, we analyzed a model with seven variables: (1) time required to load the form, (2) moving through the form, (3) availability of help screens, (4) understanding the help screen information, (5) ease of sending the form, (6) security and confidentiality procedures, and (7) overall satisfaction, including all 2-way interactions:

$$\log m_{(1234567)} = \mu + \lambda_1 + \lambda_2 + \dots + \lambda_7 + \lambda_{12} + \lambda_{13} + \dots + \lambda_{67}$$

Next, we will delete an arbitrary interaction, λ_{12} , from the model. By comparing the G^2 statistics and the p-value for the initial model vs. the reduced model we will determine whether the interaction is significant. If the G^2 and the p-value are roughly the same for the two models we can conclude that λ_{12} is not significant and we can drop the interaction from the model.

Consequently, we can exclude any three-way interactions that include λ_{12} , such as λ_{125} . If, however, λ_{12} is significant, we cannot drop any three-way interactions that include λ_{12} . We will perform this procedure for each two-way interaction, hoping to eliminate as many terms as possible to achieve the simplest model. Any higher-level interactions greater than three are extremely difficult to interpret; consequently, we will ignore them in our analysis.

Interpreting the results

The G^2 statistic, its p-value, and the degrees of freedom of the model are the criteria of a good fit. Specifically, we are looking for a simple model with a small G^2 , a large p-value, and a large number of degrees of freedom. Adding additional model terms will always decrease the value of the G^2 statistic. If the additional terms don't make an important contribution to the model then the G^2 statistic will decrease by only a small amount and the significance level may actually decrease, indicating a poorer fit to the data. This is analogous to linear regression in which the mean squared error may increase when forcing non-significant independent variables into the model.

Example of the results

Suppose we have the summary statistics for several log-linear models:

Model	G^2	d.f	p-value
Model 1 (AC,BC,ABC)	20.68	34	0.3624
Model 2 (AB,CD)	21.01	35	0.4551
Model 3 (AB)	34.98	36	0.0558
Model 4 (BC)	36.22	36	0.0126

Which model should we choose? Recall, we want a simple model with a small G^2 , a large p-value and large number of degrees of freedom. By these criteria, we will go with Model 2. The G^2 for Model 1 is smaller, but just barely. Notice, however, that the p-value for Model 1 actually decreases. We identify Model 2 as the best fit.

Table 13. IDC satisfaction ratings for the Census 2000 Internet Form

Variable	N	Percent VD (1)	Percent D (2)	Percent Neither (3)	Percent S (4)	Percent VS (5)
Time required to load the form	3216	4.1 (0.35)	0.9 (0.17)	2.8 (0.29)	28.1 (0.79)	64.2 (0.85)
Moving through the form	3210	4.2 (0.36)	1.8 (0.24)	3.5 (0.32)	27.6 (0.79)	62.9 (0.85)
Availability of help screens	3118	3.7 (0.34)	0.8 (0.16)	21.8 (0.74)	24.3 (0.77)	49.4 (0.90)
Help Users Only	1593	3.83 (0.48)	1.19 (0.27)	11.86 (0.81)	27.62 (1.12)	55.49 (1.25)
Understanding help info.	3096	3.8 (0.34)	0.8 (0.16)	23.0 (0.76)	24.0 (0.77)	48.4 (0.89)
Help Users Only	1587	3.91 (0.49)	1.39 (0.29)	13.11 (0.85)	27.10 (1.12)	54.51 (1.25)
Ease of sending form	3199	4.2 (0.35)	0.7 (0.14)	1.0 (0.18)	17.5 (0.67)	76.7 (0.37)
Security and Confidentiality procedures	3192	4.5 (0.13)	0.6 (0.45)	7.0 (0.79)	27.2 (0.86)	60.7 (0.36)
Overall Satisfaction	3198	4.4 (0.36)	1.4 (0.21)	3.2 (0.31)	25.9 (0.77)	65.1 (0.84)

Log Linear Model Comparison⁴

Model		G-squared	d.f.	p-value
Model 1--All two-way interactions	M_1	105.16	99	.3170
Model 1a (AC,AD,AE,AF,AG,BC,BD,BE, BF,BG,CD,CE,CF,CG,DE,DF,DG, EF,EG,FG)	M_1 minus (AB)	105.17	100	.3422
Model 1b (AC,AD,AE,AF,AG,BC,BD,BF, CD,CE,CF,CG,DE,DF,DG,EF,EG,FG)	M_1 minus (AB, BG, BE)	106.27	102	.3664
→ Model 1c (AC,AD,AE,AF,AG,BC,BD,BF, CE,CF,DE,DF,DG,EF,EG,FG)	M_1 minus (AB, BG, BE, CD, CG)	110.68	104	.3087
Model 1d (AC,AD,AE,AF,AG,BC,BD,BF, CE,CF,DE,DF,DG,EF,FG)	M_1 minus (AB, BG, BE, CD, CG, EG)	123.30	105	.1072
Model 2 (ADE,ADF,AEF,ADG,AEG, DEG,EFG)	M_2	4255.22	105	0.000

Which model should we choose? Recall from Appendix B, we want a simple model with a small G^2 , a large p-value and a large number of degrees of freedom. By these criteria, we will go with Model 1c. The G^2 for Model 1b is smaller, but just barely and it includes two more interactions. We identify Model 1c as the simplest and best fitting model.

⁴A=Time required to load the form
B=A availability of help screens
C=Understanding of help information
D=Moving through the form

E=Ease of sending the form
F=Security and confidentiality concerns
G=Overall satisfaction